ACCESSION #: 9501270353

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Zion Unit 2 PAGE: 1 OF 4

DOCKET NUMBER: 05000304

TITLE: System Auxiliary Transformer Deluge and Reactor Trip

EVENT DATE: 03/21/91 LER #: 91-002-01 REPORT DATE: 01/19/95

OTHER FACILITIES INVOLVED: Zion Unit 1 DOCKET NO: 05000295

OPERATING MODE: 1 POWER LEVEL: 099

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:

50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: Suzanne L. Mika, Regulatory Assurance TELEPHONE: (708) 746-2084

COMPONENT FAILURE DESCRIPTION:

CAUSE: B SYSTEM: KP COMPONENT: V MANUFACTURER: A605

REPORTABLE NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

At 0930, during the performance of Operating Periodic Test (PT)-211, Wet Pipe Sprinkler System Test, the Unit 2 Unit Auxiliary Transformer (UAT) and the Main Power Transformer (MPT) were inadvertently deluged. At 1309, another deluge occurred on the System Auxiliary Transformer (SAT) causing the SAT to trip. The buses fed from the SAT automatically transferred to the UAT. The 2A feedwater pump tripped when the SAT tripped causing a Reactor Trip on Lo-Lo Steam Generator Level. When the main generator tripped, one diesel generator (DG) was Out of Service (OOS) for maintenance so an essential bus was not automatically re-energized. A Generating Station Emergency Plan (GSEP) Unusual Event (EAL 3D) was declared at 1335 and both units were started toward Cold Shutdown. The event was caused by spurious actuation of the Unit 2 transformer's Fire Protection deluge system and the improper positioning of the Fire

Protection deluge nozzles. During this event all failures and actions taken were within the bounds of the Technical Specification limiting conditions for operation. Various corrective actions were developed and implemented to address the concerns that were raised as a result of this event.

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A. CONDITION PRIOR TO EVENT

Unit 1

MODE 3 - Hot Shutdown RX Power 0% RCS [AB] Temperature/

Pressure 540.8 degree F /2235 psig

Unit 2

MODE 1 - Power Operation RX Power 99.5% RCS [AB] Temperature/

Pressure 557.7 degrees F/ 2235 psig

B. DESCRIPTION OF EVENT

At 0930, during the performance of Operating Periodic Test (PT)-211, Wet Pipe Sprinkler System Test, the Unit 2 Unit Auxiliary Transformer (UAT) and the Main Power Transformers (MPT) were inadvertently deluged. Verification was made that no fire was present and the deluge isolation valve for both the UAT and the MPT's was subsequently closed. At 1030, after resetting the deluge valve, the Equipment Attendant (EA) began to open the manual isolation valve, but heard the deluge valve actuate again on the MPT's and the UAT, so he immediately reclosed the manual isolation valve. The Shift Supervisor (SS) verified that there was no fire and

no water actually sprayed on the MPT/UAT.

At 1245, PT-211 was resumed on the Diesel Generator Oil Storage Tank room Fire Protection System without incident. At 1303, PT-11, Diesel Generator Loading Test, was started on 2A Diesel Generator (DG) [EK] to satisfy the surveillance requirements with 0 DG Out of Service (OOS) for maintenance. After the DG was run for approximately 5 minutes, the Nuclear Station Operator (NSO) closed the output breaker of the DG and loaded it to 1 MW. While holding at 1 MW, the System Auxiliary Transformer (SAT) Trouble annunciator alarmed, the SAT, MPT, and UAT alarms on the Fire Alarm Panel then came in, and a deluge began on the Unit 2 MPT's, SAT, and UAT. The SS and an EA were dispatched from the Control Room to investigate the alarms. The SAT tripped at 1309 followed by the reserve feed breakers to Buses 243 and 244 [EA] (Breakers 2432 and 2442). Service Buses 243 and 244 automatically transferred to the UAT. Feedwater [SJ] for Unit 2, at the time of this event, was being supplied by one turbine-driven (2C) and one motor-driven (2A) feedwater pump because the second turbine-driven feedwater pump (2B) was OOS for miscellaneous maintenance. 2A feedwater pump was being fed from the SAT, and subsequently tripped when the SAT tripped. When the 2A feedwater pump tripped, insufficient feedwater to the Steam Generator [SB] caused a Reactor Trip due to Steam Generator Lo-Lo Level at 1310. At 1311, the main generator [TB] tripped,

de-energizing all Unit 2 4KV service buses. Since 2A DG was already running when the SAT tripped, the load was transferred to 2A DG after the UAT tripped, 2A DG output breaker tripped on reverse power but it immediately closed in again on the Loss of Offsite Power signal to energize essential service bus 248. 2B DG automatically started, re-energizing essential service Bus 249. The 0 DG, which provides power to Bus 247 was OOS for maintenance, so Bus 247 was manually transferred to Bus 141 which is the reserve feed for the Unit 2 essential buses.

At 1335, a Generating Station Emergency Plan (GSEP) Unusual Event (EAL 3D) was declared. The proper notifications were made and the Technical Support Center (TSC) was activated at 1410. At 1426, boration to Cold Shutdown began for Unit 2, and at 2045 cooldown was initiated for Unit 1.

After the action plan for SAT repairs had been determined and the necessary paperwork assembled, the SAT was taken OOS for repairs at 2000. Evidence showed that a phase to ground fault occurred on the Phase C bushing of the SAT. Repairs were made to the SAT, the OOS was cleared, and the SAT was re-energized at 0112.

Once the SAT was returned to service, the Unusual Event classification was changed from EAL 3D to EAL 3A, Equipment in Technical Specifications degraded such that the Limiting Condition for Operation (LCO) requires a shutdown, because 0 DG was OOS for

maintenance. A Temporary Waiver of Compliance had allowed maintenance to be performed on 0 DG while Unit 1 was left in Hot Shutdown. This Temporary Waiver of Compliance was cancelled as a result of the Unit 2 SAT trip. A second Temporary Waiver of Compliance was initiated following the SAT trip and Compensatory Actions for this Waiver required that both Units be brought to Cold Shutdown. The second Waiver was the reason that EAL 3A was implemented.

At 1830 on 3/22/91, when 0 DG was returned to service, the GSEP Unusual Event was terminated and the TSC was de-activated.

C. APPARENT CAUSE OF EVENT

The cause of the spurious actuation of the Fire Protection deluge system which resulted in the deluge of the SAT was design deficiency. A missing check valve on the SAT flowpath of the Fire Protection System caused a mechanical/hydraulic perturbation of the Fire Protection System deluge valve which resulted in the spurious actuation of the Unit 2 transformer's Fire Protection deluge system. The Fire Protection System deluge valves are automatic deluge valves that have been determined to be overly sensitive to system pressure spikes and vibration. The deluge valves for the MPT/UAT and the SAT are connected to a common Fire Protection System header. When the EA opened the 2" drain valve for the Turbine Building Wall and DG Air Intake prior to the first deluge to verify that water pressure

was being maintained up to the Turbine Building Wall deluge valve, the water pressure was sufficient to go back up through the common 2" drain valve header into the MPT/UAT deluge valve clapper protective cover and dislodge the dead weight that causes the deluge valve to open. The water was able to flow back through the common 2" drain valve header because the check valves that were supposed to prevent this flow path were never installed. A check valve was not installed on the SAT flowpath either, but the SAT was not deluged at this time. The Fire Protection deluge equipment was originally designed and supplied from the manufacturer and although pre-service testing was performed, it did not identify that these check valves were missing.

C. APPARENT CAUSE OF EVENT (Continued)

A contributing cause of the phase to ground fault on Phase C of the SAT was procedural deficiency. The Fire Protection deluge nozzles were mispositioned because no guidelines had been established for the position of these nozzles prior to this event. This mispositioning caused water to be sprayed in close proximity to Phase C of the transformer which provided a conduction path to ground, and is believed to have caused the SAT to trip.

The cause of the Unit 2 reactor trip was Low Steam Generator Level.

This Low Steam Generator Level resulted after one of the two feedwater pumps supplying the Steam Generator tripped when the SAT tripped.

D. SAFETY ANALYSIS OF EVENT

During this event all failures and actions taken were within the bounds of the Technical Specification Limiting Conditions for Operation. There was therefore no safety significance to this event.

Following the loss of the SAT and the subsequent Reactor Trip/Generator Trip, the 2A and 2B DG's assumed their safe shutdown loads per design, and all the associated safe shutdown loads actuated per design. Since the 0 DG was OOS for maintenance, essential Bus 247, which is fed from 0 DG during blackout conditions, had to be manually re-energized from it's Unit 1 cross-tie. All three essential buses were available from this point. Two essential buses are required per the Updated Final Safety Analysis Report (UFSAR) Chapter 8.4.2, so the requirements for safe shutdown were satisfied.

The Steam Generator (S/G) heat removal following the Reactor Trip was controlled by the atmospheric relief valves. Adequate S/G feedwater was supplied by the three auxiliary feedwater (AFW) pumps.

The Reactor Coolant System (RCS) pressure was controlled by the pressurizer heaters and the pressurizer auxiliary spray. The Reactor Coolant Pumps were not available because they are fed from the

non-essential buses which were de-energized due to the SAT trip and the subsequent Reactor Trip. The maximum RCS pressure attained during this event was 2347.7 psig. The Technical Specification Safety Limit for RCS pressure is 2735, so the RCS pressure was well within it's limits. The maximum average RCS temperature attained was 561.8 F which was below the Safety Limits outlined on Technical Specification Safety Limit Table (Figure 1.1-1 Reactor Core Thermal and Hydraulic Safety Limits for Four Loop Operation Units 1 and 2). Reactor Power response was normal for a Reactor Trip/Generator Trip. All control rods inserted correctly, and the Reactor Trip was completed in a normal manner.

E. CORRECTIVE ACTIONS

1. The Management Information System (MIS) department increased Sequence of Events recording priority.

2. The MIS department upgraded the process computer with a system that has faster processing speed, more memory, and disk storage.

3. The existing deluge valves on both Unit 1 and Unit 2 were replaced with Viking Fire Protection deluge valves which were found to be more reliable.

4. The Operating and Training departments reviewed the procedure and training needs for the operators on resetting the deluge valves for possible enhancement, and the appropriate procedure

changes and subsequent training were completed.

5. The Unit 1 and Unit 2 SAT Fire Protection detector systems were replaced with new detectors that have a temperature rating of 225 degrees Fahrenheit.

6. System Engineering, Site Support Engineering and Electrical Maintenance departments visually inspected the Unit 1 and Unit 2 UAT and MPT Fire Protection detector systems. The Unit 1 UAT and MPT systems were found to be in an acceptable condition. The Unit 2 UAT and MPT detection system wiring and detectors were replaced with detectors with a temperature rating of 225 degrees.

7. System Engineering, Site Support Engineering, and Operating performed PT-211 on 4-1-91 to validate the cause of the deluge actuation. The existing valves were found to be unreliable, susceptible to mechanical vibration, and installed improperly. These valves were subsequently replaced with quick opening, differential diaphragm, flood valves that have only one moving part and are held closed by water pressure differential.

8. The Operating Department revised PT-213, PT-223, PT-224, PT-225, PT-226, PT-227, PT-235 and PT-236 to minimize inadvertent alarms and to ensure that the control room is aware of actual alarms when testing is conducted.

E. CORRECTIVE ACTIONS (Continued)

9. System Engineering and Site Support Engineering determined the proper position of all transformer Fire Protection deluge nozzles and revised PT-205 to verify proper positioning of the spray valve on a periodic basis.

10. The Root Cause process now performs a group review of all significant events that occur at Zion Station. This review helps to ensure that a thorough investigation has been performed.

11. System Engineering and Site Support Engineering reviewed the impact of missing check valves on the Unit 2 Fire Protection System and determined that since the automatic deluge valves were replaced with a model that does not require this type of drain check valve, there is now no impact on the Unit 2 Fire Protection System.

12. Operating completely rewrote PT-211 for human factoring and technical adequacy.

13. The Training Department issued a letter to the Operating department explaining the Main generator reverse power trips with time delays.

14. Emergency Planning performed a GSEP lessons learned review on 4-1-91.

15. Operating revised PT-0, Appendix S and ZAP 310-02 to document any dropped 4KV breaker relays targets.

16. System Engineering and Engineering conducted a full flow test on 4-26-94 which identified discrepancies in nozzle installation and alignment. These discrepancies were corrected and procedures were changed to perform periodic verification of nozzle position.

17. The plant radio system has been upgraded to a new 900 MHZ system that was installed in 1993. This should improve communications between Operating and System Engineering during testing activities.

18. ZAP 320-01, "Access Control to the Control Room," was changed to limit the number of personnel in the control room during emergency events.

19. The Security Department revised the compensatory measures procedure for security doors to give guidance to the Security force during a system wide failure.

20. The Security and Operating departments reviewed the need for vital area keys for operators outside the vital area, and Operating was provided with four security door keys.

21. Engineering reviewed the design features that cause a deluge actuation to trip oil pumps and cooling fans but allow the SAT to remain energized and determined that the design is

appropriate.

22. Regulatory Assurance has ensured that future Notices of Enforcement Discretion (NOED) specifically indicate when the NOED is terminated and that general administrative procedure knowledge of compensatory measures is disseminated.

23. Operating revised the Standing Order to allow the Operating Engineer to revise the Standing Order distribution list based on the content of the Standing Order, cognizant individuals of the affected equipment, urgency, and the effect of the Standing Order, and also to clarify the requirements for distribution of Standing Orders.

In addition to the above actions, Zion Station has embarked upon a program to enhance the safety culture of Station personnel through the development of a critical thinking process and a questioning attitude. This was discussed by the Plant Manager with plant personnel at the April 1991 State of the Station presentation and was factored into Crew Interaction Training which was presented to all Operating personnel. The concepts of this Crew Interaction Training were shared with the rest of the station through various other training programs during 1991.

F. PREVIOUS EVENTS

DVR 22-2-90-138 documents a similar event when the Unit 2 SAT was deluged and a D/G (1A) was OOS for maintenance. The investigation did not determine the cause of the deluge, but it was noted that the automatic deluge valve was functioning properly. It is now evident that the previous event was caused by the same mechanical/hydraulic perturbations that caused this event. The investigation for the previous event focused on DC grounds on the DC power supply to the deluge system, but were inconclusive. The corrective actions for the previous event would not have prevented this event.

G. COMPONENT FAILURE DATA

None

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ComEd

Zion Generating Station

101 Shiloh Blvd.

Zion, Illinois 60099

Telephone 708/746-2084

January 19, 1995

U.S. Nuclear Regulatory Commission

Document Control Desk

Washington, DC 20555

Dear Sir:

The enclosed Supplemental Licensee Event Report number 91-002-01, Docket No. 50-304/DPR-48 from Zion Generating Station is being transmitted to you to update corrective actions taken.

Very truly yours,

E. A. Broccolo

Station Manager

Zion Generating Station

EAB/sks

Enclosure: Licensee Event Report

cc: NRC Region III Administrator

NRC Resident Inspector

INPO Record Center

Illinois Department of Nuclear Safety

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